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Concept of Operations
for
En Route Monitoring and Control
(EMAC)

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Approved by:

Director of Airway Facilities, AAF-1	**Steven B. Zaidman**	**Date:**

Submitted by:

Director NAS Operations, AOP-1	**Deborah Johnson**	**Date:**

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CONCEPT OF OPERATIONS

for

En Route Monitoring and Control (EMAC)

Foreword

This document describes a high level Concept of Operations (CONOPS) for the consolidation and integration of the En Route facility and legacy systems services, equipment, and maintenance. Throughout this document NAS Operations Managers/NAS Area Specialists (NOM/NAS) will be referred to as Service Operations Center (SOC) specialists. This document will serve as the means for communicating the users needs and expectations to provide the developer with an understanding of the desired capabilities and functionalities of the proposed EMAC system. The CONOPS is intended for Airway Facilities (AF) employees, customers, and stakeholders.

This document will be the basis for defining the procedural, investment and architectural requirements required to support the future development of EMAC. This document will serve as a *living document.*

The In-Service Management Division, AOP-1000 formed a working group to develop the EMAC Concept of Operations. The working group consisted of AF organizations representing a diverse cross-section of interests, both field and headquarters.

Please direct all questions and comments to:

Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591

Attention: Marie Sharpe, In-Service Review Manager, (ISRM), AOP-1000
E-mail: Marie.Sharpe@faa.gov
or
Stephen Bayliff, In-Service Review Manager (ISRM), AOP-1000
E-mail: Stephen.J.Bayliff@faa.gov

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NAME	ORGANIZATION
Alford, Don	AOS-330
Aurandt, Austin	AOP-300
Bayliff, Stephen	En Route ISRM, AOP-1000
Gillis, Gerry	AOP-600/Conwal
Gniechwitz, Olaf	ZOA Facility Manager
Jones, Charles	AOP-30
Keifer, Joe	Automation, Terminal and En Route Team Lead, AOP-1000
Lockhart, Beau	En Route ISRMS, AOP-1000/NISC
Martinez, Francisco	AOP-1000 En Route ISM
Roberts, Darrell	SSC-AUTO-ZMA
Sensback, John	AOS-370 ZMA Manager
Sharpe, Marie	En Route ISRM, AOP-1000

Table 1-1 EMAC CONOPS Working Group

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EXECUTIVE SUMMARY

The Program Director of NAS Operations, AOP-1, tasked AOP-1000 to form a working group to develop a concept of operations for the consolidation of monitor and control (M&C) functionality within the Air Route Traffic Control Center (ARTCC) SOC area. The working group identified a total of five areas of improvement relating to the consolidation of the M&C hardware devices and functionality into an integrated M&C platform.

- Standardize En Route M&C Architecture for Future Systems
- Increased Maintainability and Manageability of Facility and Legacy Systems
- Standardization of Human Factor Principles
- Cost Reduction
- Reduce Risk of Errors

The primary intent of the concept of operations is to identify an architecture that will satisfy user needs and improve the efficiency of the operations within the SOC area. Vast improvements to the NAS architecture have been made with the deployment of DSR and various phases of HOCSR, URET and HID/NAS/LAN. However, with these system upgrades, hardware installations have been stove-piped into the SOC without consideration of the high level operational requirements. Currently many systems require several workstations within the ARTCC SOC area. This increase in workstations, associated devices and venues has resulted in crowded conditions and an inefficient environment within the ARTCC SOC area. Additionally, the M&C for some critical systems and functions are located outside the SOC, and in some cases, not even on the same floor of the building.

The SOC M&C architecture needs to be consolidated and configured to provide necessary service level functions utilizing modern technologies. The SOC specialists have the crucial task of managing the operations and maintenance of NAS equipment. EMAC will contribute to the FAA's goal of reducing outages and delays by providing a centralized working environment for the SOC specialist that will allow more efficient organization and display of status and maintenance information.

The En Route Automation Modernization (ERAM) system will include an internal integrated M&C functionality and a platform for future operational systems but will not provide a consolidated M&C for the remaining facility and legacy systems. Technological advances and industry practices have produced the capability to consolidate M&C functions of numerous systems into network architecture designed specifically for M&C.

The EMAC architecture will allow consolidation of legacy system M&C functions along with facility monitoring systems, connectivity to NIMS, data sharing, and a consistent Computer Human Interface (CHI). EMAC will be part of the solution to separate critical functions from essential and routine functions to eliminate the possibility of data corruption and enhance system availability. A standardized EMAC infrastructure will allow future programs to benefit from reduced cost baselines in functional areas such as training and software development, and will provide support for service level monitoring.

In addition to the development of the concept of operations, the working group identified two recommendations to support the initial set of systems to be integrated in FY04 and FY05, under the auspices of EMAC.

- Upgrade the Data Acquisition System and Real-time Status Display (DAS/RSD) to replace HOCSR Phase 3 M&C.
- Perform HID/NAS/LAN Tech Refresh and incorporate the HID M&C into the DAS/RSD replacement.

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TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

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1.0 INTRODUCTION

1.1 BACKGROUND

The AOP-1 letter dated June 8, 2000, entitled "Consolidation of En Route Monitoring and Control Functionality", directed the consolidation of En Route M&C functionality to reduce costs and the risk of errors resulting from the proliferation of displays in the SOC. The EMAC CONOPS will establish a basis for a standards-based open architecture for M&C that will accommodate the consolidation of legacy systems, new facility monitoring systems, and planned NIMS connectivity. The EMAC CONOPS will initially remain separate from that of ERAM. The EMAC CONOPS will support the managed evolution from today's Airway Facilities (AF) environment to that of the future.

1.2 PURPOSE

The purpose of this document is to ensure that all members of the AF operations community, customers, and service providers share a *common vision and understanding* of the proposed EMAC concept and its related objectives defined below:

- An improved and standardized En Route M&C architecture for facility and legacy systems within the SOC at the twenty-one ARTCCs.
- An initial framework to guide the development of the operational requirements and system architecture that provides for consolidation, standardization, and expandability through integration of future M&C systems.
- A supporting infrastructure, which will include training, simulation, information display, enhanced support software, and M&C services.
- More efficient and cost beneficial use of human resources and delivery of NAS services.

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2.0 SCOPE

The scope of this document describes the current situation, user needs and expectations, and a concept of operations for a notional EMAC system architecture. It does not describe an end-state system. This document assumes that the reader has some familiarity and understanding of the AF operations within the SOC area.

2.1 DOCUMENT OVERVIEW

This intended audience for this document is the AF and AT community, customers, and stakeholders. This concept of operations is intended to be the first step towards developing the final Requirements Document (fRD).

2.2 SERVICE OPERATIONS CENTER (SOC) OVERVIEW

Most SOCs have a finite core set of equipment that is common to all ARTCCs, which will be referred to as "facility and legacy" systems. Most facilities have hardware and software that is specific to their particular operation (i.e. one of a kind systems, military systems, and home defense and special operations). Each system is managed and controlled separately, and has unique command structures and different CHI attributes. Figure 1-1 represents the different M&C displays within the SOC area:

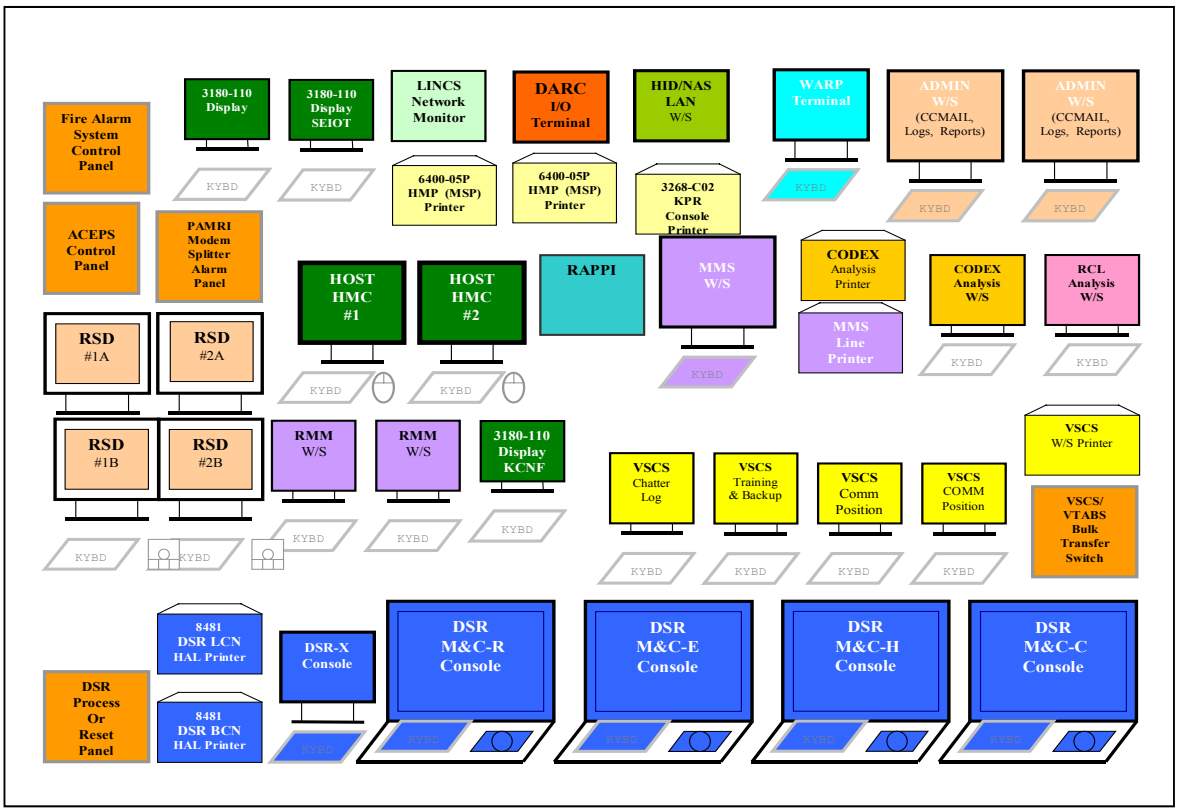

Figure 1-1 Service Operations Center (SOC) Overview

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3.0 REFERENCE DOCUMENTS

- AF Concept of Operations for the Future, FAA/AUA, March 1, 1995.
- ATS Concept of Operations for the National Airspace System in 2005, Federal Aviation Administration, September 30, 1997.
- AMCC Monitor and Control Integration Human Factors Study, Logicon Federal Data Sciences and Solutions (LFDSS), September 28, 2001
- Military Standards 498 (MIL-STD-498), Software Development and Documentation, Department of Defense, December 5, 1994.
- IEEE Guide for Concept of Operations Documents, Institute of Electrical and Electronics Engineers, Inc., January 4, 1998.
- En Route and Oceanic Mission Needs Statement (MNS-309), FAA/ARX, November 6, 1997.
- FAA Order 6000.15c, General Maintenance Handbook for Airway Facilities, FAA/AOP, August 11, 2000.

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4.0 DESCRIPTION OF THE CURRENT SITUATION

4.1 BACKGROUND

The M&C capabilities of the critical En Route Air Traffic Control (ATC) systems have evolved independently over several decades resulting in a "stovepipe," sporadic architecture. As the systems and their devices multiplied, the workspace became cluttered and management of M&C information became laborious. The information needed by the SOC specialist may not even be available on a single floor of an ARTCC.

Each independent En Route facility and legacy system has an M&C function that must be managed differently. Each has a distinct set of hardware and software technologies with unique devices and displays that were developed as standalone solutions. While several of the critical M&C functions have been technically refreshed, none have addressed efficiency in the multiple system environments. The ARTCC SOC area, formerly called the ARTCC Maintenance Control Center (AMCC) area is currently overcrowded with M&C displays, devices of standalone systems and entirely devoid of M&C for other entities such as security and prime power. Consolidation of legacy M&C systems and the addition of other select capabilities will enhance the SOC specialist's capability to perform their duties.

The SOC specialist has the primary responsibility for coordination of M&C activities within the ARTCC SOC. The SOC specialist uses the information displayed on the M&C devices to manage the operations and maintenance activities of the systems.

The *Airway Facilities CONOPS for the Future* envisions a complete, integrated, and consolidated ARTCC M&C solution as documented in the *En Route and Oceanic Mission Needs Statement (MNS-309)* approved in 1997. The ERAM program was established to address the En Route automation needs described in MNS-309 which include the requirements for integrating the HOST related M&C functions. ERAM does not include requirements for consolidating the M&C functions of any other legacy and facility systems or future systems.

Logicon Federal Data Sciences and Solutions conducted a study to determine the methods available to meet the FAA's need for M&C management. This study recommended a consistent, consolidated M&C infrastructure. However, requirements for consolidating the M&C functions of en route facility and legacy systems were deferred to potential future programs. Additionally, ARTCC legacy systems M&C functions do not currently provide the capability to forward data for collection, dissemination, and reporting purposes.

4.2 ROLES AND RESPONSIBILITIES

There is a critical need for improving the work environment within the SOC area; therefore it is important to define the different areas of responsibilities and the levels of coordination required for SOC specialists. SOC specialists perform a variety of functions directly relating to the operation of the NAS. SOC specialists are responsible for M&C of facility and legacy systems, coordination of restoration activities, and developing solutions to unforeseen situations. SOC specialists are responsible for coordinating with and in some instances, directing the activities of the following:

- Airway Transportation System Specialists (ATSS's) within the System Service Center (SSC) are responsible for certifying and performing periodic and corrective maintenance on airway facilities systems, including automation, communication, navigation, surveillance and weather.
- Air Traffic Operations Managers, who are responsible for meeting operational needs by directing, coordinating, controlling, and ensuring the safe and efficient utilization of the national airspace system.
- Regional offices that are responsible for the management and coordination of daily operations of equipment within their respective geographical area.
- The National Operations Control Center (NOCC) which is responsible for the integration of Operations Control Center (OCC), activities and priorities and provides NAS infrastructure status reporting, emergency disaster management, and tactical planning at a national level.
- AF headquarters offices that provide national direction and guidance and establish policy and standards for operation and maintenance of the NAS.

- Operational Support (AOS) personnel who are responsible for on-site and second level automation support.
- On-site NAS Implementation (ANI) personnel who are responsible for infrastructure modifications, system integration and deployment.

4.3 CUSTOMERS AND SERVICE PROVIDERS

SOC specialists are the primary focal point for providing 24x7 hour assistance to AF customers and leased service providers. They are responsible for daily coordination and interaction with military officials, and other FAA personnel including Air Traffic, airlines, and county and city officials.

4.4 LIMITATIONS OF CURRENT M&C CONFIGURATION

Incremental development of M&C functions has led to inconsistent CHI attributes among the many different displays, command structures, function key assignment, menus and mnemonics functions, and alert and alarm usage. This inconsistent CHI can lead to confusion or delayed responses among SOC specialists as they attempt to determine appropriate situational actions. Under current conditions, it is possible to inadvertently cause or extend failure durations due to the lack of or the misinterpretation of M&C information. The current M&C environment is based on individual components and systems without regard to service delivery function or the tasks necessary for SOC specialists to most efficiently assess the impact on overall NAS operations. The concluding paragraphs of this section outline limitations of the current M&C environment.

4.4.1 ENVIRONMENTAL SYSTEMS

- **Security/Closed-circuit television monitoring**

  LIMITATIONS:
  Security monitoring responsibility has not been standardized nationally.

- **Central Control and Monitoring System (CCMS)**
  Some ARTCC's may have environmental monitor terminals in the SOC area; others use the Data Acquisition System/Real-time Status Display (DAS/RSD) to monitor selected parameters for alarms.

  LIMITATIONS:
  No standardization and has limited monitoring points with respect to the DAS/RSD.

- **ARTCC Critical/Essential Power Systems (ACEPS)**
  ACEPS serves as the power system for the ARTCC and responds to changing power conditions through various operation modes. Alarms and alerts are indicated on enunciator panels. Some ARTCC may have an indicator panel mounted in the SOC.

  LIMITATIONS:
  Engine Generator status and control not provided
  Indicator panel is bulky and non-standard (i.e. green lights which traditionally indicates a normal condition, actually indicates a negative condition) and is not located in SOC area at most centers.
  Remote master alarm at most ARTCCs is inadequate.

- **Fire Alarms**
  The ARTCC fire alarm system serves as the fire detection and alarm system zoned through the different facility areas.

LIMITATIONS:

Fire alarm monitoring systems are not standardized from ARTCC to ARTCC. May be limited by national and local fire code requirements (i.e., approved alarm box must be used).
Fire alarms may not be located within the SOC area at most ARTCCs.

4.4.2 VOICE COMMUNICATIONS SYSTEMS

- **Voice Switching and Control System (VSCS)**
  The VSCS integrates air to ground and ground-to-ground communication at ARTCC's into software driven, computer controlled switching system that provides communications between controllers and en route aircraft. VSCS also provides intercom communications within and between ground facilities.

  LIMITATIONS:
  None known.

- **Voice Switching and Control System Training and Backup System (VTABS/VCSU)**
  VTABS allows for access to air-to-ground and ground-to-ground communications resources independently of VSCS in the event of a catastrophic failure of the VSCS, loss of power sources, or planned/unplanned maintenance activities.

  LIMITATIONS:
  Another monitor in the SOC.
  Bulk Transfer panel.

- **Radio Control Equipment (RCE)**
  RCE is the ARTCC remote control equipment for RCAGs.

  LIMITATIONS:
  No monitoring capability within the SOC.

- **High Capacity Voice recorders (HCVR)**
  Records controller air-to-ground, ground-to-ground, and interfacility communications. DAS/RSD provides monitoring capability through HCVR.

  LIMITATIONS:
  Some sites have added digital recorders that are not compatible with DAS/RSD, which requires monitoring.

4.4.3 DATA COMMUNICATION SYSTEMS

- **Data Multiplexing Network (DMN)**
  The DMN is a data communication network system managed by a Motorola 9000NT network management system.

  LIMITATIONS:
  Runs an HP open view application, which is not standard within the SOC.

- **Radio Communications Link (RCL)**
  The RCL is a microwave radio communications link between ARTCC facilities and remote facilities managed by the ACORN network control system (ANCS).

  LIMITATIONS:
  Monitoring capability is not located within the SOC at all ARTCCs.

- **National Airspace Data Interchange Network (NADIN)**

  LIMITATIONS:
  Only master alarmed monitored through DAS/RSD.

- **Leased Interfacility NAS Communications System (LINCS)**

  LIMITATIONS:
  Monitoring capability is not located within the SOC at all ARTCCs.

4.4.4 EN ROUTE AUTOMATION

- **Air Traffic Control Computer (ATCC)/Central Computer Complex Host (CCCH) subsystem**
  Computer system hosting the NAS automation software and will be replaced with ERAM.

  LIMITATIONS:
  KCNF, KVDT has green/black monitors and it is difficult to see the status.
  HOCSR M&C CHI is difficult to use.
  Multiple printers are located in the SOC area.

- **Enhanced Direct Access Radar Channel (EDARC)**
  Provides backup radar data for NAS radar data distribution and will be replaced by ERAM.

  LIMITATIONS:
  Non-standard interfaces.

- **Display System Replacement (DSR)**
  Provides display processing and consoles for ATC controller position and will be merged into ERAM.

  LIMITATIONS:
  Non-standard interfaces.

- **Peripheral Adaptor Module Replacement Item (PAMRI)**
  Provides the interface to the remote radar sites and distributes radar data to NAS and will be replaced by ECG.

  LIMITATIONS:
  Only provides power supply monitoring.

- **Host Interface Device NAS Local Area Network (HID/NAS LAN)**
  HID Network System Monitor (NSM) provides monitor and control for the HID and CPDLC.

  LIMITATIONS:
  Standard NetView application, not user friendly.

- **Random Access Plan Position Indicator (RAPPI)**
  The RAPPI system allows the NOM to evaluate radar data and the state of radar sites. May have printer attached.

  LIMITATIONS.
  Limited to monitoring a maximum of 16 radars.

- **Center/TRACON Automation System (CTAS)**
  It is used as a metering tool to assist AT with sequencing of aircrafts in and out of a terminal environment and is part of the Traffic Management Advisory (TMA) system.

  LIMITATIONS:
  M&C monitor is not within the SOC area.

- **User Request Evaluation Tool (URET)**
  To be merged into ERAM

  LIMITATIONS:
  None known.

- **Oceanic Display and Planning System (ODAPS)**
  ODAPS provides automated flight data and conflict probe to allow effective assignment of routes and altitudes for oceanic air traffic.

  LIMITATIONS:
  KCNF, KVDT has green/black monitors and is difficult to see status.
  HOCSR M&C CHI is difficult to use.
  Multiple printers are located in the SOC area.

- **Oceanic Flight Data Processing System (OFDPS)**
  OFDPS is a processor subsystem, which handles the flight data processing routine at Micro-EARTS facilities for oceanic air traffic.

  LIMITATIONS:
  KCNF, KVDT has green/black monitors and is difficult to see status.
  HOCSR M&C CHI is difficult to use.
  Multiple printers are located in the SOC area.

- **Flight Service Data Processing System (FSDPS)**
  Interface into the flight service stations.

  LIMITATIONS:
  Only the master alarm is monitored in the SOC area.

4.4.5 INFORMATION

- **Weather and Radar Processor (WARP)**
  WARP collects, processes, and disseminates NEXRAD and other weather information.

  LIMITATIONS:
  No audible alarm if WSR-88 radar data is missing.

- **Data Acquisition System/ Real Time Status Display (DAS/RSD)**
  Has two CPUS and four monitors in SOC area. Provides graphical display and Tabular list of alarms. Provides a monitoring platform for legacy system. Monitors EDARC, CCMS, HCVRs, and miscellaneous environmental and site-specific requirements. Has CHI that is accepted by all sites.

  LIMITATIONS:
  Obsolete hardware, past end of life
  Software support not funded. Has unused screens that need to be removed.
  Monitor only, does not provide control functions.
  Four monitors, two workstations in SOC area.

- **Event Manager**

- **Remote Maintenance Management System (RMMS) software called MASS**

- **Maintenance Management System (MMS)**
  Event Manager, MASS, and MMS have three workstations in the SOC area. W/S's support all programs. MASS is used to provide monitor and control of remote radar sites. MMS support facility log keeping requirements, upward reporting and pm scheduling. Event Manager is used to sequence, prioritize and track daily maintenance operations with event tickets.

  LIMITATIONS:
  Three workstations in SOC area.
  Printer.

- **Administrative Data Terminals**
  Workstation provides E-mail and local admin functions for NOMs to meet local requirements. May have security terminals.

  LIMITATIONS:
  None known.

4.4.6 SUMMARY OF LIMITATIONS

The above list is not all-inclusive. Some ARTCCs may have site-specific systems and monitoring requirements. A detailed study needs to be conducted to determine all common requirements:

- SOC area hardware must be updated to accommodate integration, future growth and expected NAS modernization efforts.
- Obsolete monitoring equipment needs to be replaced.
- The SOC area M&C capability is not all-inclusive and some systems external to the SOC area require monitoring.
- Support tools are needed to provide service level status to the SOC specialists.
- Common interfaces are needed for unique systems.

5.0 CONCEPT OF OPERATIONS

This concept is a vision for providing compatibility and common functionality of existing and planned monitoring and control of en route systems. The primary goal is to provide for better utilization of resources, workload prioritization, thus reducing logistics cost by providing a standardized platform for M&C capability and functions. The EMAC concept of operation incorporates, as a primary directive, an approach for establishing an intuitive user environment. EMAC should have design features enabling a smooth, uninterrupted transition from the current system architecture to the future operational system.

The intent of EMAC is to provide service level monitoring, control and management for SOC specialists. The overall concept consists of consolidating and standardizing monitor and control features from which a SOC specialist could configure and maintain facility and legacy systems in a more efficient manner. This should facilitate more consistent M&C software development and provide better utilization of space within the SOC area. All future systems should be required to have their M&C functionality through the EMAC system.

All operational systems are candidates for service level monitoring and control. Additionally, non-operational systems such as building and grounds security, heating ventilating and air conditioning (HVAC), fire/life/safety, and power systems should also be incorporated into the baseline M&C architecture. Support systems used by the SOC specialist for event logging and upward reporting should be integrated as part of the immediate workspace configuration.

M&C devices selected for consolidation should have their functions incorporated into the baseline architecture. EMAC should be based on a network management architecture utilizing open standards and protocols. A new graphical user interface (GUI) and configurable screens should enable users to correlate and manage an ARTCC's services, events, equipment, network health, and gather performance data. EMAC should be designed and implemented in a way that allows for tailoring to meet the site-specific needs and expectations.

5.1 OPERATIONAL PHILOSOPHY

The operational philosophy is to migrate from a system based M&C infrastructure to a service based M&C environment. The highest level of functionality should address the service levels. Indicators should direct the SOC specialists to system levels for analysis and problem resolution. EMAC should have sets of integrated M&C consoles from which the SOC specialists can perform real-time status monitoring, corrective maintenance, schedule events, administrative tasks, system configuration and management of service recovery, restoration, and certification. The incorporation of functionality and focusing on system capability, as related to impact on service delivery, will assist with accommodating current and expected workloads.

From an operational viewpoint, EMAC will accommodate individual audible and visual alarms and standardize the presentation of displays, colors, and command structure, and other identified standardized CHI into a common scaleable and configurable platform. This integration will minimize the number of hardware elements currently required by the SOC specialists. The control of systems and equipment contributing to any service should require a minimum amount of actions to expedite system level analysis. Uninterrupted monitoring and control status within the SOC workspace, from a service perspective, comprises the core capability of EMAC.

5.2 OPERATIONAL ENVIRONMENT

The SOC specialists should have the capability of instantaneously monitoring the level of services being provided to the customer(s). Service level monitoring allows for a consistent environment regardless of the systems and equipment that are providing the service (i.e., systems can change though the services will remain the same). The following outlines the services provided by an ARTCC.

These services comprise the baseline monitoring capabilities of EMAC. The associated systems are the current means of providing the service. The control features of EMAC should accommodate any systems providing or contributing to a service. Refer to FAA Order 6000.15 that defines the systems, subsystems, and services requiring certification.

The following sections describe a conceptual working environment within the SOC. These sections are divided into service areas that include existing and future functionality. Under each service area is a list of systems that may support the service. The SOC specialists need to have the capability to monitor and control the systems in the following service areas:

5.2.1 COMMUNICATIONS

- **En Route Communication Voice Exchange (ECVEX)**
  - Voice Switching and Control System (VSCS)
  - Voice Switching and Control System Training and Backup System (VTABS/VCSU)
  - Back Up Emergency Communication System (BUEC)
  - Remote Center Air Ground System (RCAG)
  - Radio Control Equipment (RCE)
  - Digital Voice Recording System (DVRS)

- **En Route Communication Data Exchange (ECDEX)**
  - Data Multiplexing Network (DMN)
  - Radio Communications Link (RCL)
  - Leased Interfacility NAS Communications System (LINCS)
  - FAA Telecommunications Infrastructure (FTI)
  - Controller Pilot Data Link Communications (CPDLC)
  - Oceanic Data Link (ODL)

5.2.2 SURVEILLANCE

- **En Route Surveillance Airborne Target Display (ESATD)**
  - Host and Oceanic Computer System Replacement (HOCSR)
  - Enhanced Direct Access Radar Channel (EDARC)
  - Display System Replacement (DSR)
  - En Route Communications Gateway (ECG)
  - En Route Automation Modernization (ERAM)
  - Host Interface Device NAS Local Area Network (HID/NAS LAN)
  - Random Access Plan Position Indicator (RAPPI)
  - Flight Data Input/Output (FDIO)
  - Center/TRACON Automation System (CTAS)
  - User Request Evaluation Tool (URET)
  - Enhanced Backup Surveillance (EBUS)
  - Micro En Route Automated Radar Tracking System (MEARTS)
  - Radar Data Entry and Display (RDED)
  - Air Route Surveillance Radar (1/2/3/4) (ARSR)
  - Air Route Surveillance Radar (SSR DMTI FPS-20)
  - Air Traffic Control Beacon Interrogator 3/4/5/6 (ATCBI)
  - Mode-S Data Link
  - Remote Tower Alphanumeric Display Service (RTADS)

- **General Information Traffic Flow Management (GITFM)**
  - Enhanced Traffic Management System (ETMS)

- **En Route Oceanic Target Display (ESOTD)**
  - Advance Technologies and Oceanic Procedures (ATOP)
  - Oceanic Display and Planning System (ODAPS)
  - Oceanic Flight Data Processing System (OFDPS)
  - Composite Oceanic Display and Planning Service (CODAP)
  - Composite Offshore Flight Data Service (COFAD)

5.2.3 INFORMATION

- **General Information Aircraft Flight Plan (GIAFP)**

- **Air Traffic Control Computer (ATCC) / Central Computer Complex Host (CCCH) Subsystem**

- **En Route Information Weather Display (EIWXD)**
  - Weather and Radar Processor (WARP)

- **En Route Command and Control (ENCIC)**
  - Data Acquisition System/ Real Time Status Display (DAS/RSD)
  - Remote Maintenance Management System (RMMS)

- **Maintenance Automation System Software (MASS)**

- **Administrative Data Terminal**
  - Event Manager
  - Maintenance Management System (MMS)
  - Cru-X
  - E-mail
- **En Route Service Support Facilities (ESVSF)**
  - ECS/CCMS
  - Fire Life Safety
  - Physical Security
  - Critical Power Distribution Systems (ACEPS)

5.2.4 MAINTENANCE PHILOSOPHY

The maintenance philosophy within the SOC area consists of a complete first level responsibility approach. In today's environment, ATSS's are required to maintain various system components in the SOC area and equipment rooms. This philosophy will not change under EMAC.

ATSS personnel are responsible for removing and replacing major components (i.e.: monitor, processor, keyboard, trackball, mouse) within the SOC area. The line replaceable unit (LRU) maintenance level (i.e. integrated circuit board, processors and disk drives, etc) will be accomplished in the equipment room. This is based on the fact that the SOC is an operational environment used primarily for real-time monitoring and control of the major systems within the ARTCC and is not equipped with of all the elements or space (i.e.: power strips, maintenance lamps, grounding straps) required to properly perform full-scale diagnostics/problem determination activities.

Under EMAC, if the SOC specialist can resolve the problem by simply rebooting the system or unloading/reloading the software at the SOC, then he will do so. However, if there is a major software failure either on the primary or backup system (i.e.: loss of redundancy), then the SOC specialist will notify the appropriate ATSS, who will then perform the necessary software modifications/diagnostics and certification actions in the equipment room area.

The way maintenance is performed at the SOC, from a responsibility, maintaining, and repair perspective will remain the same under EMAC. By having common system components and functionality maintenance efficiency and ease of operation will improve within the SOC area.

5.3 DESCRIPTION OF CONCEPTUAL PROTOTYPE

A prototype should be developed to demonstrate system capability, functionality and commonality. The EMAC prototype system should be based on a combination of identifying operational goals, analyzing the current M&C operations and tasks, identifying operational problems, analyzing system-by-system information and control requirements, and applying human factors principles, based on the AF Human Factors standards.

The EMAC prototype may consist of M&C displays and support tools that allow the users (i.e. SOC specialists, ATSS's) to have a consolidated and common situational awareness of all facility services and legacy systems M&C functions. Figure 1-2 represents the conceptual EMAC architecture***. Although the diagram shows a single large status display the total number of consoles and displays has not been determined.***

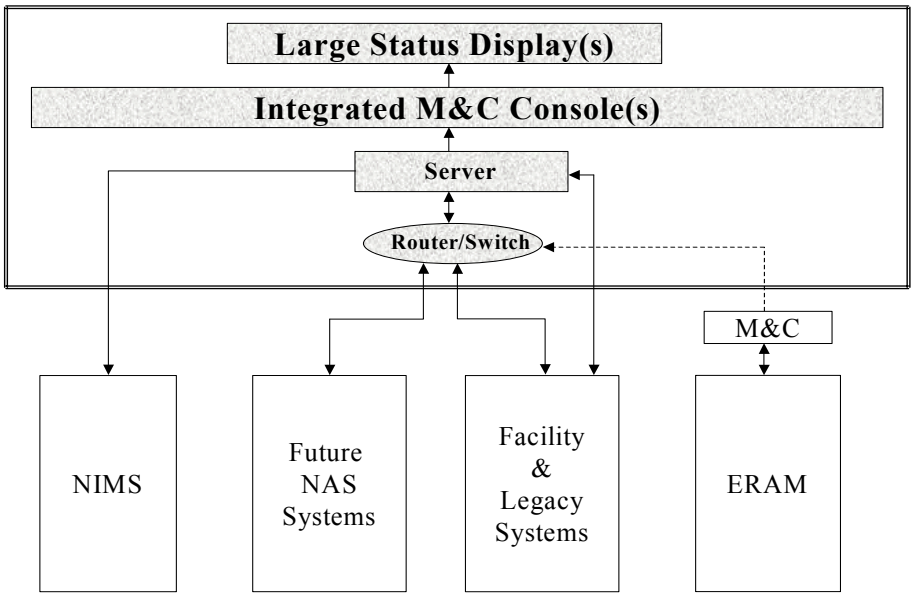

Figure 1-2 EMAC Concept Diagram

The conceptual high-level EMAC architecture illustrates connectivity of future NAS systems, facility and legacy systems, and NIMS. The architecture is currently independent of the ERAM program. EMAC needs to have the capability to send and receive system information of display on the integrated M&C console(s) and large status display(s). ***The above diagram does not describe an end-state system.***

6.0 SUMMARY

As technology advances, our focus must remain firmly fixed on ways to improve the efficiency of the operations within the SOC area. Vast improvements to the NAS architecture have been made with the deployment of DSR, URET, HID/NAS/LAN and of HOCSR's various phases. However, with these system upgrades, hardware replacements have been stove-piped without consideration of the overall SOC operation. The SOC area needs to be configured to provide necessary service level functions utilizing modern technologies.

The EMAC architecture will allow consolidation of legacy system M&C functions along with facility monitoring systems, connectivity to NIMS, data sharing, and a consistent CHI. EMAC will be part of the solution to separate critical functions from essential and routine functions to eliminate the possibility of data corruption and enhance system availability. A standardized EMAC infrastructure will allow future programs to benefit from reduced cost baselines in functional areas such as training and software development, and will provide achievement of service level support.

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APPENDIX A

TERMS, ACRONYMS & DEFINITIONS

TERM/ACRONYM	DEFINITION
AAF-1	Director of Airway Facilities
ACEPS	ARTCC Critical/Essential Power Systems
ADT	Administrative Data Terminal
AF	Airway Facilities
AMCC	ARTCC Maintenance Control Center
AOP-1	Program Director of NAS Operations
AOP-100	NAS Operations, National Operations Division
AOP-1000	NAS Operations, In-Service Management Division
AOP-30	NAS Operations, Infrastructure Management
AOP-300	NAS Operations, NAS Policy Division
AOP-600	NAS Operations, En Route Facilities Division
AOS-330	NAS Operational Support, En Route Peripherals System Support Branch
AOS-370	NAS Operational Support, En Route Operational Field Support Branch
AOS-530	NAS Operational Support, Remote Maintenance Monitoring and Engineering Support Branch
ARTCC	Air Route Traffic Control Center
AT	Air Traffic
ATC	Air Traffic Control
ATCC	Air Traffic Control Computer
ATOP	Advanced Technologies and Oceanic Procedures
ATSS	Airway Transportation System Specialist
CAP	Civil Air Patrol
CCCH	Central Computer Complex Host
CCMS	Central Control and Monitoring System
CHI	Computer-Human Interface
CODAP	Composite Oceanic Display and Planning Service
COFAD	Composite Offshore Flight Data Service
CONOPS	Concept of Operations
CPDLC	Controller-Pilot Data Link Communications
CRU-X	FAA developed labor distribution recording system.
CTAS	Center/TRACON Automation System
DAS/RSD	Data Acquisition System/Real-time Status Display
DMN	Data Multiplexing Network
DSR	Display System Replacement
EBUS	Enhanced Backup Surveillance
ECDEX	En Route Communication Data Exchange
ECG	En Route Communications Gateway
ECS	Environmental Control System
ECVEX	En Route Communication Voice Exchange
EDARC	Enhanced Direct Access Radar Channel
EMAC	En Route Monitoring and Control
EMAIL	Electronic Mail
ENCIC	En Route Command and Control
ENIWD	En Route Information Weather Display

ERAM	En Route Automation Modernization
ESATD	En Route Surveillance Airborne Target Display
ESOTD	En Route Oceanic Target Display
ETMS	Enhanced Traffic Management System
FAA	Federal Aviation Administration
FDIO	Flight Data Input/Output
FRD	Final Requirements Document
FTI	FAA Telecommunications Infrastructure
GIAFP	General Information Aircraft Flight Plan
GITFM	General Information Traffic Flow Management
HID/NAS/LAN (HNL)	Host Interface Device/NAS/Local Area Network
HOCSR	Host and Oceanic Computer System Replacement
HOST (computer system)	The heart of the ATC system. It collects flight plan and radar data from aircraft and forwards it to controllers at the en route centers.
HVAC	Heating, Ventilation and Air Conditioning
IEEE	Institute of Electrical and Electronics Engineers
ISRM	In-Service Review Manager
ISRMS	In-Service Review Manager Support
LINCKS/RCE	Leased Inter-facility NAS Communications System
M&C	Monitor and Control
MASS	Maintenance Automation System Software
MIL-STD-498	Military Standard 498
MMS	Maintenance Management System
MNS-309	En Route & Oceanic Mission Need Statement
NAPRS	National Airspace Performance Reportable System
NAS	National Airspace System
NAS	NAS Area Specialist
NIMS	NAS Infrastructure Management System
NOCC	National Operations Control Center
NOM	NAS Operations Manager
NOM/NAS	SOC Specialist
OCC	Operations Control Center
ODAPS	Oceanic Display and Planning System
ODL	Oceanic Data Link
OFDPS	Oceanic Flight Data Processing System
RAPPI	Random Access Plan Position Indicator
RCE	Remote Control Equipment
RCL	Radio Communications Link
RMMS	Remote Maintenance Management System
SME	Subject Matter Expert
SMO	System Management Office
SOC	Systems Operation Center
SOC Specialist	NAS Operations Manager/NAS Area Specialist
SSC	System Support Center
SSC-AUTO-ZMA	System Support Center-Automation-Miami ARTCC
TBD	To be determined
TRACON	Terminal Radar Approach Control
URET	User Request Evaluation Tool

VCSU	VSCS Control System Upgrade
VSCS	Voice Switching and Control System
VTABS/VCSU	VSCS Training and Backup System/VSCS Control System Upgrade
WARP	Weather and Radar Processor
ZOA	Oakland ARTCC